DOCUMENT RESUME

ED 358 803 HE 026 537

AUTHOR Wagener, James W.
TITLE The Education Professorate: Teaching an "Artificial" Science.
PUB DATE 15 Apr 93
NOTE 12p.; Paper presented at the American Educational Research Association Conference (Atlanta, GA, April 15, 1993).
PUB TYPE Viewpoints (Opinion/Position Papers, Essays, etc.) (120) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Higher Education; Intellectual Disciplines; Learning; Metaphors; *Preservice Teacher Education; Professors; Skill Development; *Teacher Role; *Teacher Student Relationship; *Undergraduate Study

ABSTRACT

This paper argues that conceiving the education professor's role in higher education as that of teaching an "artificial" science is a helpful metaphor for re-contextualizing this mission. How the use of the metaphor of an artificial science bears on the role of the education professorate is examined by applying the purposive-inner environment-outer environment model to the tasks of the teacher, the professor, and the education professor. Each task is discussed within the context of artificial science while examining the student's learning progress from the introduction to knowledge to the level of practice. The paper concludes with the concepts of "indwelling," applied to skill development and performance; and "pedagogical modeling," used to give teachers guidance in connecting knowledge and the experience of the learner with flexibility and variety. Contains 32 references. (GLR)

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James W. Wagener

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THE EDUCATION PROFESSORATE: TEACHING AN "ARTIFICIAL" SCIENCE

James W. Wagener

WHAT IS AN "ARTIFICIAL" SCIENCE?

This paper contends that conceiving the education professor's role as that of teaching an "artificial" science is a helpful metaphor for re-contextualizing this mission. Herbert A. Simon defines an artificial science as an artificially (and artfully) constructed interface between an inner and an outer environment in the service of a stated purpose or goal (1969). Simon identifies

> . . . four indicia that distinguish the artificial from the natural; hence we can set the boundaries for sciences of the artificial:
>
> 1. Artificial things are synthesized (though not always or usually with full forethought) by man.
> 2. Artificial things may imitate appearances in natural things while lacking, in one or many respects, the reality of the latter.
> 3. Artificial things can be characterized in terms of functions, goals, adaptation.
> 4. Artificial things are often discussed, particularly when they are being designed, in terms of imperatives as well as descriptives (1969, pp. 4-6).

The purposive or goal-seeking aspect of an artificial science is crucial to this understanding. This functional aspect of artificial things, Simon states, requires "a relation among three terms: the purpose or goal, the character of the artifact, and the environment in which the artifact performs" (1969, p. 6). An example he uses to illustrate this relation is that of a clock. Its purpose is clear in a child's definition: "a clock is to tell time." But when an adult focuses on the clock itself, she may "describe it in terms of arrangements of gears, and of the application of the forces of springs or gravity operating on a weight or pendulum" (1969, p. 6).

The purpose and character of an artifact exists in relation to the third element, the environment in which the artifact does what it is intended to do. Sundials, Simon says, work as clocks in sunny climates, but not in Arctic winters. Pendulum clocks perform in hallways of houses but not on rolling and pitching ships. The latter environment required the development of kinds of chronometers that would tolerate the movement of the oceans and yet keep time accurately enough to pinpoint longitudes (1969, p. 6).

An artifact in this context, then,

> . . . can be thought of as a meeting point--an "interface" in today's terms--between an "inner" environment, the substance and organization of the artifact itself, and an "outer" environment, the surroundings in which it operates. (1969, p. 7)

An artificial science is a science of design. It is appropriate to such "practice" endeavors as engineering, architecture, medicine, urban planning, and teaching. Each of these enterprises is purposive; there is a goal to be reached. Each relies on an inner environment that rests, to a greater or lesser degree, on the findings and technological products of natural sciences and/or behavioral sciences. Each is practiced in an outer environment in which the inner environment must be appropriate if the project or goal is to be served.

In the best of all possible worlds, Simon says,

> We might hope to be able to characterize the main properties of the system [goals, inner environment, and outer environment] and its behavior without elaborating the detail of <u>either</u> the outer or inner environments. We might look toward a science of the artificial that would depend on the relative simplicity of the interface as its primary source of abstraction and generality.
> [Brackets and contents added] (1969, p. 9)

How the use of the metaphor[1] of an artificial science bears on the role of the education professorate will be examined by applying the purposive-inner environment-outer environment model to the tasks of the teacher, the professor, and the education professor. I have called these the teaching artiface, the professing artiface, and the praxis artiface.

THE "TEACHING" ARTIFACE

The teacher's role, conceived in terms of an artificial science, is to design an interface between the inner environment of the student and the outer environment of knowledge. These environments may be conceived in multiple ways. There is no single acceptable frame of reference (or set of frames of reference) dictated by this metaphor that the teacher must have in order to "understand" or "help" this student pedagogically.

Some developmental frames of reference seem to work better as pedagogical assumptions than others. Some cognitive theories seem to foster learning progress better than others. Some assumption sets about the student's state appear to enable the teacher to interact with the student in ways that both the teacher and the student value. But "work better," "make progress," and commonly "value" are relative terms which arise out of the noetic

communities and belief systems, formal or informal, which inform the teacher and the student.

Also, the meaning and valence of these terms are tied to the "interests" of the student and the teacher[2] So, while we constantly make relative judgments about the adequacy of developmental and cognitive theories, there is no objective referee's box in which we can stand and pronounce the one (or even two) "true" theory(ies). However, it does not follow from this that all theories are then equal. Some are more comprehensive, or more coherent, or simpler, or more elegant. We should, can, and do make these judgments all the time. No matter how good the explanation, it does not exhaust the meaning of the inner environment.

Another way of saying this is that when dealing with live learners no reductionist scheme can <u>totally</u> explain the inner environments which these people are.

The outer environment of the teaching artifact is knowledge. Similar cautions about absolutizing as mentioned about the inner environment apply here. Sometimes "knowledge" is treated as a stuff. Sometimes it is treated as a platform. Sometimes it is organized hierarchically. Sometimes it is strung together or chained. Sometimes it is used as a flag or a marker. Sometimes it is treated as a talisman, sometimes as a tool. Sometimes it is viewed as representing something else. Sometimes it is considered an abstraction which is empty of content; sometimes a mirror, sometimes a construct, sometimes a solution, sometimes a skill.

The interface between the inner environment of the student and the outer environment of knowledge is initiation into a language game, to borrow a phrase from Richard Rorty (1991, p. 80) and others. Rorty argues, correctly I believe, that the pragmatist's response to the claim that science deals with hard facts and the other disciplines should try their best to reach this high mark is to offer

> . . . an analysis of the nature of science which construes the reputed hardness of facts as an artifact produced by our choice of language game. We construct games in which something definite and uncontrollable happens. In some Mayan ball game, perhaps, the team associated with a lunar deity automatically loses, and is executed, if the moon is eclipsed during play. In poker, you know you've won if you're dealt an ace-high straight flush. In the laboratory, a hypothesis may be discredited if the litmus paper turns blue, or the mercury fails to come up to a certain level. A hypothesis is agreed to have been "verified by the real world" if a computer spits out a certain number. <u>The hardness of fact in all these cases is simply the hardness of the previous agreements within</u>

a community about the consequences of a certain event.
[Emphasis added] (Rorty, 1991, p. 80)

The teaching artiface is initiation. Initiation into a language game is to learn the folkways and knowledge claim constructs of the community of that game, to participate in the language interactions, questions, and assurances of that game.

THE "PROFESSING" ARTIFACE

The inner environment of the professor-student relationship is the student with citizenship in the language game of schooling. This is the student who has been initiated into some universe of knowledge claims and resides with a degree of comfort and facility in that realm.

The outer environment of this artiface is the presence of other language games, some disparate and foreign, some cognate and at hand. This typology is, of course, artificial in the sense that awareness of alternative ways of knowing is not forestalled until a student is in a postsecondary setting. He, no doubt, comes to awareness, at least, of alternative knowledge claims as he goes from course to course in a comprehensive high school or before. Elementary, middle, and senior high school is not just initiation, even though that is the primary mode of interface.

Although many contemporary college and university professors might be uneasy with the legacy of their vocation as someone who professes something, the verb connotes a dimension of choosing a stand and upholding it. This upholding bespeaks other choices which might be professed, that is, alternative knowledge claims and ways of knowing.

These alternatives characterize the interface between students-with-the-language-of-schooling and other language games in their universe (as in "university") of discourse. The artiface between the inner and outer environments of this relationship can be characterized as critique, in the broadest sense of that term. If the student moves from initiate (or, rarer these days, disciple) to colleague, she also may move to critic of some or all of the claims of her mentor. This comes about because of alternative language games within the same discipline or field or different disciplines with different (as opposed to foreign) languages.

This enterprise of learning the dialogue of criticism is not necessarily a disenchantment with one's native disciplinary language. It may be a response to alternative questions or to a gathering interest in issues or knowledge communities that resonate differently or proceed with different methods and techniques.

Critique, from the standpoint of the initiate or insider, may

result in at least two findings that depend on the knower looking from within the home discipline. The two are complementarity and disjuncture. Complementarity reflects the partiality and incompleteness of a unifocal view. Cognate pairing of points of view may bridge the insularity or complement the deficit of a single language game with resulting knowledge benefits to both fields. Disjuncture may, conversely, indicate fault lines in the discipline which may be a clue to a potential paradigm shift.

THE "PRAXIS" ARTIFACE

A professor of education, like a professor of medicine, social work, engineering, or urban planning has a different task than a professor of history, biochemistry, or statistical demographics. These academics educate for practice of one kind or another. They do not focus primarily on concepts, although concepts are surely a part of demonstrating practice. They do not foster the use of particular methodologies or techniques in general separate from the uniqueness of the particular learners or the learning environment, although ways of doing are surely a part of the focus of these professionals.

Practice cannot be simply divided into "what" and "how:" what to teach and how to teach it. Discussions about the content-methods divisions, theory-practice dichotomies, and teaching-learning splits of the near past tended to sag into dreary and debilitating exercises that produced little that was enabling or insightful. Part of the difficulty in addressing these issues has been the scarcity of contexts for holding the polarities together--or in dealing with them in ways that do not polarize.

The artificial science metaphor may hold some advantages in considering education for praxis, and particularly the education of teachers as practitioners. By the time teacher candidates get into a professional program at either the undergraduate or graduate levels, they should be initiated into the language game and be possessors of well developed critical functions.

The inner environment of the third artifact <u>is</u> the student with these competencies in place to one degree or another. The outer environment, conversely, is not, as in the former stages, a language game or set of language games themselves. It is rather the students-being-initiated or the students-becoming-critical, depending on which practice the student teacher is being guided toward. The artifact matching the inner and outer environments together in this phase is <u>praxis</u> itself. My use of this term involves two elements, indwelling and modeling, which will be considered in the two final sections of this paper.

INDWELLING

Indwelling, a concept articulated by Michael Polanyi, holds

that all knowing of whatever kind has two simultaneous dimensions, a tacit or subsidiary dimension and a focal dimension. An easy to grasp example of this knowing process which Polanyi used often is the accomplishment (and all knowing, to his thinking, is an accomplishment) of recognizing a person's face from among hundreds of faces. The knower "indwells" the particulars which the face presents. This is the tacit or subsidiary dimension from which the person focally recognizes the person without any doubt. At the same time the knower is hard pressed to specify the particulars which made recognition positive and quick. The knower recognizes the person without some abstract model or mental picture which is called up. He recognizes the face by "indwelling" it (Polanyi, 1958 and 1966).

Indwelling is not restricted to perception and recognition although there are many dimensions to those elements. Indwelling extends to skill development and performance. The skill of riding a bicycle is not, according to Polanyi, learned by appropriating the principles of physics which underly the successful negotiation of a bike ride. It is learned by dwelling in the bicycle as an extension of yourself and making the mind/body adjustments necessary to propel the vehicle forward in a balanced state. This noetic model, incidentally, makes moot the usual dichotomies between concept and skill, perception and concept, theory and practice, abstract and concrete, etc.

Stating subsidiary/focal awareness in terms of teaching practice involves a knower relying <u>subsidiarily</u> on information particulars of the inner environment of the student-with-language-games while relying <u>focally</u> on some element of the disciplinary methods/knowledge base of the outer environment for the sake of accomplishing a learning task or goal. The obverse of this process is the same: the knower can rely <u>focally</u> on an aspect of the inner environment while relying <u>subsidiarily</u> on the particulars of the external environment for the sake of a noetic accomplishment. This action is an integrating and cohering accomplishment which is purposive rather than comprehensive.

The advantages of this model used for this purpose are many. First, it obviates the artificial notion of learning a theory abstractly and attempting to "carry" it to a site and "apply it concretely." The theory, if one needs to maintain this antiquated language game, is immanent to the knower/known exchange. Second, it makes moot the artificial distinctions we try to maintain between perception, conceptual constructs, skills, and performances of every kind, including the arts. Third, it is holistic in the sense that it does not try to dissect experience into pieces for the sake of abstract (and useless) cataloging. Fourth, although I cannot develop the narrative of it here, knowledge claims are held with universal intent in the sense that they prevail until another noetic accomplishment renders them less useful. Thus, we live epistemologically confident in today's noetic accomplishments not

because of any notion that we have certainty--we do not--but because the noetic configuration is the best light we have for this part of our journey, even though it may and probably will be replaced. This concept closes the front gate to forms of inevitable progress, which we are not currently prone to but which may return, and the back gate to a debilitating relativism, to which we are currently prone.

Polanyi's notion of indwelling offers, I believe, a rich source for understanding the process of engendering practice, the charge under which most professors of education labor, to one degree or another.

MODELING

A second help in delineating the praxis artiface is through modeling. What, for example, are the pedagogical proficiences which the education professor is trying to engender? Can they be dipped out of the teaching soup without becoming abstract conceptual bones?

These proficiencies are of a different order than the sense and sensibility engendered in a historian qua historian or in a psychologist qua behavioral scientist. They are also different from teaching strategies and curricular schemes. They have to do with the logic employed to bridge the inner and outer environments to meet a goal. Marc Belth's works (1965, 1970) were richly suggestive in this regard but they did not find a wide or empathetic readership.

Wed to Polanyi's structure of tacit knowing, Belth's notion of pedagogical modeling need not become an exercise in abstract application because the models can be subsidiarily relied upon rather than used as scruffy notes mechanically relied upon by a public speaker.

Belth's models are an effort to engender the pedagogical logics of the disciplines in the teacher. These logics are different from chronological orders or common sense structures. They represent derived models which attempt to give the teacher ways to connect knowledge and the experience of the learner with flexibility and variety.

Belth asks

> Is doing something the same as being equipped with the conceptual means to do something? Is simple consciousness sufficient as a defining criterion for either teaching or learning? Is it not, rather, consciousness of a special kind that is part of these distinct but related phases of education?
>
> (1970, p. 78)

The instruments of this "consciousness of a special kind" Belth called pedagogical models. He identified five such models: dialectical (to engender the ability to set definitions and analyze), didactic (to engender the ability to explore, observe, and describe), paradigm (to engender abilities for category-construction, explanation, and invention), monologue (to engender the ability to interpret), and projection (to engender the ability to read the present historically and to project it into a more fulfilled form) (1970, pp. 130 and 136).

Belth contended that this list was not definitive or exhaustive, and he urged the identification and development of new models to reflect a broader range of interfaces.

The education professorate is in the interesting position of being able to explore more fully and imaginatively the domain of the artificial science of pedagogy which rests between the inner environment of students-as-initiates-and-critics and the outer environment of enabling-students-to-become-initiates-and-critics. This interface is both pedagogy as praxis and praxis as pedagogy, depending on where you indwell.

NOTES

1.Some may argue that an artificial science notion is more than a metaphor and there may be merit to that position. For my purposes in this paper I am limiting my usage to the metaphoric as a means of recontextualizing or reweaving the praxis of the educational professorate.

2."Interest is attached to actions that both establish the conditions of possible knowledge and depend on cognitive processes, although in different configurations according to the form of action. . . . The act of self-reflection that 'changes a life' is a movement of emancipation. Here the interest of reason cannot corrupt reason's cognitive power, because . . . knowing and acting are fused in a single act" (Habermas, 1971, p. 212). Habermas makes a distinction between the instrumental action of pragmatists and his development of communicative action as a part of critical theory. This paper is more sympathetic to pragmatic instrumental action than to Habermas's attempts to ground his critical theory, but I am indebted to him for demonstrating again the "interest" dimension of pragmatism.

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